MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

BEM1014 – MATHEMATICS
(All sections / Groups)

17 OCTOBER 2018
2.30 p.m - 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **7 pages** including cover page with **4 Questions** only.
2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.
3. Mathematical formulae are provided at the end of the paper.
4. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

Question 1 (20 marks)

(a) Solve the inequality $|5x+7| \geq 18$.

[3 marks]

(b) Find an equation of a straight line passing through (4, -5) and perpendicular to the line $3y = -\frac{2}{5}x + 3$.

[3 marks]

(c) Solve $\sqrt{p-2} + 2 = \sqrt{2p+3}$.

[4 marks]

(d) The demand function for Plantronics Voyager 5200 Bluetooth headsets is given by

$$p = d(x) = -0.025x^2 - 0.5x + 60$$

where p is expressed in dollars and x is measured in units of a thousand. Find the maximum number of headsets demanded per month.

[5 marks]

(e) The demand function for a production line of computer is $p = 2400 - 6q$, where p is the price per unit when q units are demanded by consumers. Find the level of production that will maximize the manufacturer's total revenue, and determine this revenue (revenue, $r = pq$).

[5 marks]

Continued...

Question 2 (25 marks)

Harrison Paint produces both interior and exterior paints from two raw materials, Raw Material 1 and Raw Material 2. The following table provides the basic data of the problem:

	Tons of raw material per ton of		
	Exterior paint	*Interior paint*	**Maximum daily availability (tons)**
Raw Material 1	6	4	24
Raw Material 2	1	2	6
Profit per ton (RM1000)	5	4	

A market survey indicates that the daily demand for interior paint cannot exceed that of exterior paint by more than 1 ton. Also, the maximum daily demand of interior paint is 2 tons. Harrison Paint wants to determine the optimum (best) product mix of interior and exterior paints that maximizes the total daily profit.

(a) Formulate a linear programming model for this problem. **[8 marks]**

(b) Solve the LP problem graphically and state the optimal solution. **[17 marks]**

Question 3 (25 marks)

(a) How many monthly payments (to the nearest integer) of RM100 must be planned to have a future value of RM1,878.58 when the interest is 5% compounded monthly?

[5 marks]

(b) Five and a half years ago, Maya invested RM10,000 in a retirement fund that grew at the rate of 10.82% compounded quarterly. What is her account worth today?

[5 marks]

Continued...

(c) John and his wife are planning to go to Europe 3 years from now and have agreed to set aside RM150 per month for their trip. If they deposit this money at the end of each month into a saving account paying interest at the rate of 8% compounded monthly, how much money will be in their travel fund at the end of the third year?

[5 marks]

(d) Ian purchased a house for RM200,000. He made a down payment of 20% of the purchase price and secured a 30 years home mortgage at 6% per year compounded monthly on the unpaid balance. How much was their month mortgage payment for the house?

[5 marks]

(e) Rayyan borrowed RM120,000 from a bank to help finance the purchase of a house. The bank charges interest at a rate of 5.4% per year on the unpaid balance, with interest computations made at the end of each month. Rayyan have agreed to repay the loan in equal monthly instalments over 30 years. How much should each payment be if the loan is to be amortized at the end of the term?

[5 marks]

Question 4 (30 marks)

(a) Adamson Company manufactures a home theatre system. The quantity x of these theatre system demanded each week is related to the whole-sale unit price (in dollars) by the equation

$$p = -0.006x + 180 \qquad (0 \leq x \leq 30{,}000)$$

The weekly total cost (in dollars) incurred by Adamson Company for producing x units is

$$C(x) = 0.000002x^3 - 0.02x^2 + 120x + 60{,}000$$

(i) Find the revenue function, R(x) and the profit function, P(x).

[4 marks]

(ii) Find the marginal revenue function, R'(x) and marginal cost function, C'(x).

[2 marks]

(iii)Find the marginal cost when the x=7000. Interpret the result.

[3 marks]

Continued...

(b) Differentiate $y = 5x^3\sqrt{2x+7}$.

[5 marks]

(c) Given $f(x,y) = e^{xy^2}$,

(i) Find f_{xx} and f_{xy}. **[3 marks]**

(ii) Compute $f_{xx}(5,2)$ and $f_{xy}(5,2)$. **[2 marks]**

(d) Solve the following indefinite integral using integration by substitution:

$$\int 3x^2\sqrt{x^3+2}dx$$

[5 marks]

(e) Find the area of the region R under the graph of $f(x) = e^{\frac{1}{2}x}$ from $x = -1$ to $x = 1$.

[6 marks]

End of Page.

Course: Mathematics
Code: BEM 1014

Summary of Principal Formulas and Terms

Simple Interest
(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P\,(1 + rt)$

Compound Interest
(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest
$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

Future Value of an Annuity
$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$
(S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity
$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$
(P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula
$$R = \frac{Pi}{1-(1+i)^{-n}}$$
(R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula
$$R = \frac{Si}{(1+i)^n - 1}$$
(R = periodic payment required to accumulate S dollars over n periods)

Basic Rules of Differentiation

(a) Chain rule: Derive $g[f(x)] = g'[f(x)]f'(x)$

(b) General power rule: Derive $[f(x)]^n = n[f(x)]^{n-1} f'(x)$

(c) Exponential function: Derive $e^x = e^x$
Derive $(e^u) = e^u[u'(x)]$

(d) Logarithmic function: Derive $\ln x = \dfrac{1}{x}$

Derive $(\ln u(x)) = \left(\dfrac{1}{u(x)}\right)[u'(x)]$

Basic Rules of Integration

(a) Exponential function: $\int e^u du = e^u + C$

(b) Logarithmic function: $\int \left(\dfrac{1}{u}\right) du = \ln u + C$

Determining Relative Extrema

$$D(x, y) = f_{xx} f_{yy} - (f_{xy})^2$$

If $D > 0$ and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If $D > 0$ and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If $D < 0$, (x, y) is neither maximum nor minimum.
If $D = 0$, the test is inconclusive.